

periments consisted in first observing the rate of leakage through the air in a closed vessel as before, the apparatus being then taken into an underground tunnel and the observations repeated there. If the ionisation were due to such a cause, we should expect to observe a smaller leakage underground on account of absorption of the rays by the rocks above the tunnel.

For these experiments a portable apparatus had to be made, shown in fig. 2 [omitted]. It differed from that already described (fig. 1) in the following respects: The vessel of thinly silvered glass as before, was inverted and attached directly to the sulphur condenser, its neck being imbedded in the sulphur. The electroscope formerly used to test the constancy of the potential of the supporting rod was dispensed with; all need for external wires was thus removed. Only the end of the wire by which the charge was put into the condenser protruded from the sulphur, and this was covered as shown in the figure, except at the moment of charging, by a small bottle containing calcium chloride; this fitted tightly on a conical projection of the sulphur through the center of which the wire passed. The sufficient constancy of potential of the supporting rod under these conditions was shown by the fact that when it had been put, by means of the magnet, in momentary electrical connection with the leaking system a second contact, made twenty-four hours later, caused the gold leaf, which indicated the potential, to return to within two micrometer scale divisions of its position immediately after the first contact. The change in the potential of the leaking system produced by such a change in the potential of the support was much too small to be detected.

The experiments with this apparatus were carried out at Peebles. The mean rate of leak when the apparatus was in an ordinary room amounted to 6.6 divisions of the micrometer scale per hour. An experiment made in the Caledonian Railway tunnel near Peebles (at night after the traffic had ceased) gave a leakage of 7.0 divisions per hour, the fall of potential amounting to 14 scale divisions in the two hours for which the experiment lasted. The difference is well within the range of experimental errors. There is thus no evidence of any falling off of the rate of production of ions in the vessel, although there were many feet of solid rock overhead.

It is unlikely, therefore, that the ionisation is due to radiation which has traversed our atmosphere; it seems to be, as Geitel concludes, a property of the air itself.

The experiments described in this paper were carried out with ordinary atmospheric air, which had in most cases been filtered through a tightly fitting plug of wool. The air was not dried and no experiments have yet been made to determine whether the ionisation depends on the amount of moisture in the air.

It can hardly be doubted that the very few nuclei which can always be detected in moist air by the expansion method, provided the expansion be great enough to catch ions, are themselves ions merely made visible by the expansion, not, as some former experiments seemed to suggest, produced by it. The negative results then obtained, in attempts to to remove the nuclei by a strong electric field, may, perhaps, be explained if we consider that all ions set free in the interval during which the supersaturation exceeds the value necessary to make water condense upon them, are necessarily caught, so that complete absence of drops is not to be expected even with the strongest fields.

The principal results arrived at in this investigation are (1) that ions are continually being produced in atmospheric air (as is proved also by Geitel's experiments), and (2) that the number of each kind (positively and negatively charged) produced per second in each cubic centimeter amounts to about twenty.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—Hourly observations at the Observatory, San Jose de Costa Rica, during April, 1901.

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Duration, 1901.
	660+ Mm.	660+ Mm.	° C.	° C.	%	%	Mm.	Mm.	Hrs.
1 a. m.	4.33	3.34	17.01	17.37	80	84	0.0	0.6	0.00
2 a. m.	3.99	3.47	16.68	17.13	79	85	0.0	0.3	0.00
3 a. m.	3.74	3.33	16.20	16.68	80	85	0.0	0.0	0.00
4 a. m.	3.73	3.21	16.38	16.82	81	84	0.0	0.3	0.00
5 a. m.	3.90	3.44	16.17	16.73	81	82	0.0	0.1	0.00
6 a. m.	4.03	3.79	16.34	16.80	80	84	0.6	0.1	0.67
7 a. m.	4.52	4.21	18.11	18.56	73	79	0.2	1.9	0.25
8 a. m.	4.75	4.53	20.53	20.68	63	70	0.0	1.3	0.00
9 a. m.	4.86	4.66	22.67	22.59	56	64	0.0	0.2	0.00
10 a. m.	4.77	4.56	24.53	24.53	50	56	0.0	1.2	0.00
11 a. m.	4.52	4.35	25.07	25.32	49	52	0.0	0.1	0.00
12 m.	4.00	3.92	26.34	25.94	47	55	0.0	0.7	0.00
1 p. m.	3.54	3.30	26.55	26.20	48	55	0.0	1.6	0.00
2 p. m.	3.12	2.81	26.33	25.36	50	59	0.0	3.2	0.00
3 p. m.	2.86	2.55	25.38	25.98	55	63	0.0	8.1	0.00
4 p. m.	2.81	2.52	23.63	23.54	60	68	0.0	4.9	0.00
5 p. m.	3.01	2.72	21.84	21.30	67	73	0.0	5.9	0.00
6 p. m.	3.97	3.19	24.40	20.11	72	76	0.0	4.4	0.00
7 p. m.	3.83	3.65	19.54	19.24	73	81	0.0	3.7	0.00
8 p. m.	4.34	4.08	18.94	18.90	79	82	0.0	2.1	0.00
9 p. m.	4.58	4.35	18.53	18.45	77	82	0.0	1.3	0.00
10 p. m.	4.98	4.64	18.12	18.07	76	84	0.0	1.2	0.00
11 p. m.	4.99	4.60	17.71	17.74	79	85	0.0	1.5	0.00
Midnight	4.74	4.29	17.34	17.53	80	85	0.0	0.7	0.00
Mean	664.06	663.75	20.47	20.36	68	74	.....	.....	.....
Minimum	661.20	660.43	12.3	10.8	.....	.....	.....	.....	.....
Maximum	666.60	667.12	32.5	34.7	.....	.....	0.6	8.1	.....
Total	.....	.....	.....	.....	.....	.....	0.8	42.8	0.92

REMARKS.—The barometer is 1,160 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The dry and wet bulb thermometers are 1.5 meters above ground and corrected for instrumental errors. The hourly readings for pressure, wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The hourly rainfall is as given by Hottinger's self-register, checked once a day. The standard rain gage is 1.5 meters above ground.

TABLE 2.

Time.	Sunshine.		Cloudiness observed, 1901.	Temperature of the soil at depth of—				
	Observed, 1901.	Normal, 1889-1900.		0.15 m.	0.30 m.	0.60 m.	1.30 m.	3.00 m.
	Hours.	Hours.	%	° C.	° C.	° C.	° C.	° C.
7 a. m.	8.50	13.16	44	23.44	22.83	23.03	21.75	20.96
8 a. m.	23.25	21.78						
9 a. m.	23.82	22.14						
10 a. m.	23.80	21.84	47	23.92	22.91	23.07	21.86	.....
11 a. m.	20.88	21.58						
12 m.	21.59	20.09						
1 p. m.	22.84	19.81	53	23.79	23.35	23.13	21.85	.....
2 p. m.	22.50	19.25						
3 p. m.	20.43	15.80						
4 p. m.	17.34	13.24	60	23.92	23.35	23.11	21.77	.....
5 p. m.	12.74	9.86						
6 p. m.	5.51	4.95						
7 p. m.	.....	.....	52	23.60	23.32	23.06	21.74	.....
8 p. m.	.....	.....				
9 p. m.	.....	.....				
10 p. m.	.....	.....	34	23.80	23.22	23.03	21.73	.....
11 p. m.	.....	.....				
Midnight	.....	.....				
Mean	.....	.....	48	23.35	23.19	23.09	21.80	20.96
Total	222.20	205.59	.....	.....	.....	.....	.....	.....

Notes on the weather.—During the first seven days of the month there were protracted calms and other indications of an early beginning of the rainy season, but on the 8th the northeast monsoons began to blow again permanently, with a high relative pressure of the air until the 17th, inclusive. The 18th and 19th were close and warm, with threats of rain

in the afternoon. From the 20th to 30th the weather was windy and cloudy, with daily rains in the northern range of the Cordillera. The short shower on the 21st, at San Jose, had no action whatever on the soil, which remains unusually dry and dusty. On the Atlantic slope the first half of the month was pretty dry, with only occasional showers; the second half rather wet.

Earthquakes.—April 13, slight tremors at 4h. 42m. p. m. April 16, 1h. 23m. p. m., strong shock, northwest to southeast; duration, 5 seconds; intensity, 2. April 30, 3h 33m. p. m., slight tremors.

TABLE 3.—Rainfall at stations in Costa Rica, 1901.

Stations.	January.		February.		March.		April.	
	Amount.	No. rainy days.	Amount.	No. rainy days.	Amount.	No. rainy days.	Amount.	No. rainy days.
	<i>Mm.</i>		<i>Mm.</i>		<i>Mm.</i>		<i>Mm.</i>	
1. Boca Banano.....	265	17	98	11	278	14	219	16
2. Limon.....	304	19	72	9	214	15	193	12
3. Swamp Mouth.....			131	10	241	13	302	11
4. Zent.....							246	14
5. Gute Hoffnung.....	411	15	106	14	224	12	235	11
6. Siquirres.....	408	10	45	4	160	8		
7. Guapiles.....	340	13	114	8			231	7
8. Sarapiquí.....							243	19
9. San Carlos.....	301	19	67	14	96	13	110	13
10. Las Lomas.....	521	16	131	10	181	14	66	4
11. Peralta.....	335	11	65	4	190	13	150	9
12. Turrialba.....							85	10
13. Juan Vinas.....	159	14	40	10	12	6	50	8
14. Santiago.....							66	9
15. Paraiso.....								
16. San Rafael C.....								
17. Tres Rios.....	2	1	5	1	0	0	2	1
18. La Palma.....								
19. S. Francisco G.....	7	2	9	1	26	1	1	1
20. San Jose.....	4	2	9	1	24	1	1	1
21. La Verbena.....			5	2	6	2	1	1
22. San Isidro Alajuela.....	0	0	1	1			8	1
23. Nuestro Amo.....			11	2	50	3	0	0
24. Sipurio.....					149	12	239	13

TABLE 4.—Zent (station of the United Fruit Company), April, 1901.

	7 a. m.	1 p. m.	6 p. m.	Mean.
Temperature (degrees)	22.27	28.86	25.58	25.73
Relative humidity (per cent)	90	69	84	79
Cloudiness (per cent)	53	59	60	58
Temperature of the soil (degrees)	0.15 m.	27.38	27.32	27.66
	0.30 m.	27.43	27.35	27.39
	0.60 m.	27.69	27.67	27.68

Sunshine.							
Hours a m.	6-7	7-8	8-9	9-10	10-11	11-12	Total.
Per cent.....	0.54	12.48	15.91	16.44	16.63	14.67	.....
Hours p. m.	12-1	1-2	2-3	3-4	4-5	5-6	135.06
Per cent.....	15-17	14.26	13.30	10.35	5.31	0.0	

MONTHLY STATEMENT OF AVERAGE WEATHER CONDITIONS FOR APRIL.

By Prof. E. B. GARRIOTT.

The following statements are based on average weather conditions for April, as determined by long series of observations. As the weather of any given April does not conform strictly to the average conditions, the statements can not be considered as forecasts:

In the middle latitudes of the North Atlantic Ocean west of the thirtieth meridian storms are less frequent, while to the eastward of the thirtieth meridian and between the fortieth and sixtieth parallels storms are more frequent than during the preceding three months. There is an increase in

the number of foggy days from the Grand Banks to the coast of the United States, and icebergs are likely to be encountered near Newfoundland and the Grand Banks as far south as the forty-first parallel, and possibly to the fortieth parallel.

In the West Indies April is the last month of what is generally termed the dry season. The wet season, which begins in May, continues through October.

Although the well-marked wet season of the Pacific coast of the United States extends from October to March, the monthly rainfalls gradually diminish from December and January to July and August. The latter two months named cover a practically rainless period in that section. Over the interior of the United States a large proportion of the more important storms of April develop on the middle-eastern slope of the Rocky Mountains, and move thence north of east over the Lake region and New England. On the Great Lakes and along the middle Atlantic and New England coasts the near approach of a storm of this type is indicated by rapidly-falling barometer and increasing east to south winds.

In the trucking districts of the interior of the Gulf and South Atlantic States damaging frost is likely to occur in April. Frost is likely to occur in the early part of the month in the Pacific Coast States, in the region immediately bordering the Gulf of Mexico, and in the north half of the Florida Peninsula.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletín Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published in our Chart IV.

Mexican data for April, 1901.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
Leon (Guanajuato)...	<i>Feet.</i> 5,901	<i>Inch.</i> 31.25	89.1	45.7	69.3	81	0.03	nw.	sw.
Linares (Nuevo Leon)...	1,188	28.62	102.2	50.0	76.3	58	1.34	s.	s.
Mazatlan.....	25	29.87	79.0	60.4	70.3	76	.....	nw.	sw.
Mexico (Obs. Cent.)...	7,472	23.02	84.2	44.8	64.8	41	0.53	nw.	sw.
Morelia (Seminario)...	6,401	23.98	83.7	49.6	65.8	47	0.35	s.	w.
Puebla (Col. Cat.)...	7,125	23.36	84.0	50.0	67.5	43	0.40	e.	ws.
Saltillo (Col. S. Juan)...	5,399	24.73	87.8	42.8	65.1	63	2.16	ne.	s.
S. Isidro (Hac. de Gto)...	.....	.....	77.9	64.4	.....	.....	0.08	ne., w.	.....
Zapotlan (Seminario)...	5,078	25.04	89.6	49.6	70.7	63	.....	sse.	w.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Popular Science Monthly. New York. Vol 59.
Cook, F. A. Aurora Australis. Pp. 21-33.